

PATENT

Attorney Docket No. 9792909-5787

IN THE CLAIMS:

1. (Currently amended) A method of manufacturing ~~method of~~ a semiconductor apparatus[[,]] comprising:

forming a first mask material film made of organic insulation film on a film to be processed;

forming a tapered aperture pattern, in which a bottom of said aperture pattern is made narrower than an open side of said aperture pattern on said first mask material film; and

forming a vertical aperture pattern in said film to be processed by etching said film to be processed by using said first mask material film as a mask;

wherein the bottom of the tapered aperture pattern is formed at a desirable micro dimension exceeding capabilities of lithography techniques.

2. (Currently amended) The method of manufacturing ~~method of~~ a semiconductor apparatus according to claim 1[[,]] further including removing said first mask material film.

3. (Currently amended) The method of manufacturing ~~method of~~ a semiconductor apparatus according to claim 1[[,]] wherein said film to be processed has a step.

4. (Currently amended) The method of manufacturing a semiconductor apparatus ~~manufacturing method~~ according to claim 1[[,]] wherein said first mask material film is made of material having a low dielectric constant.

5. (Canceled)

6. (Currently amended) A method of manufacturing a semiconductor apparatus comprising:

providing a film to be processed on a substrate;

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providing a resist film on at least one dielectric mask material film, said dielectric mask material film being disposed on said film;

forming an aperture pattern on said resist film; and

using said resist film as a mask and etching said dielectric mask material film to form an open pattern, said open pattern being formed with tapered sides such that a bottom of said open pattern is narrower than an aperture side of said open pattern; and

forming a vertical aperture pattern in said film by etching said film;

wherein the bottom of the open pattern is formed at a desirable micro dimension exceeding capabilities of lithography techniques.

7. (Currently amended) The method of manufacturing a semiconductor apparatus according to ~~Claim 6~~ claim 1 wherein said ~~etching of said first mask material film to form an open~~ forming of the tapered aperture pattern is carried out by includes setting a temperature of said substrate to minus 50 to 0 degrees Centigrade.

8 (Currently amended) The method of manufacturing a semiconductor apparatus according to ~~Claim 6~~ claim 1 wherein said first mask material film has a dielectric constant lower than silicon dioxide.

9 (Currently amended) A method of reducing a contact hole diameter in a semiconductor apparatus[[,]] comprising:

providing a film to be processed on a substrate;

disposing at least one dielectric mask material film on said film;

providing a resist film on at least one the dielectric mask material film;

forming an aperture pattern on said resist film; and

using said resist film as a mask and etching said dielectric mask material film to form an open pattern, said open pattern being formed with tapered sides such that a bottom of said open pattern is narrower than an aperture side of said open pattern, wherein said bottom of said open pattern is formed at a desirable micro dimension exceeding capabilities of lithography techniques; and

vertically etching said film to obtain the contact hole with the reduced diameter.

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10 (New) The method of manufacturing a semiconductor apparatus according to claim 1 further comprising forming a second mask material film on the first mask material film.

11 (New) The method of manufacturing a semiconductor apparatus according to claim 10 wherein the first mask material film is made of FLARE or SILK.

12 (New) The method of manufacturing a semiconductor apparatus according to claim 10 further comprising forming a resist film on the second mask material film.

13 (New) The method of manufacturing a semiconductor apparatus according to claim 12 further comprising etching the resist film.

14 (New) The method of manufacturing a semiconductor apparatus according to claim 13 further comprising etching the second mask material film.

15. (New) The method of manufacturing a semiconductor apparatus according to claim 3 wherein forming the first mask material film on the film planarizes an unevenness created by said step.

16 (New) The method of manufacturing a semiconductor apparatus according to claim 6 wherein providing the film to be processed on the substrate includes disposing the film to be processed directly on the substrate.